

Notes on the Swedish species of the genus *Centromerus* F. Dahl (Araneae, Linyphiidae)

A faunistic report with ecological remarks

By TORBJÖRN KRONESTEDT

Existing knowledge of the Swedish spider fauna is very inadequate in comparison with that of many other arthropod groups. The distribution of most spider species within Sweden is poorly known and probably a number of species are still overlooked. Thus, though the present paper does not set out to be a full and final report on the Swedish distribution of the species of the linyphiid genus *Centromerus*, there is for zoogeographical purposes, for instance, a need for contributions on the Swedish spider fauna owing *inter alia* to the geographical position of the country, and this article is intended partly as such a contribution to this end.

The various *Centromerus* species hitherto found in Sweden are listed below together with notes on their distribution, data on the seasonal occurrence and activity of the adults of some species. Notes are also given on the habitats in which some of the species have been found. The data on the seasonal activity have been obtained by pitfall trapping (Barber traps containing formalin as a preservative). These data are depending on the activity of the animals moving on the ground surface. Factors which influence this are the abundance of the species and their susceptibility to trapping (intensity of activity varies from species to species and according to stage reached in the life-cycle). Furthermore the trap catches are dependent on different exogenous factors, abiotic as well as biotic. The structure of the habitat (e.g. the density and structure of the vegetation) may also influence the activity. Generally speaking, the adult specimens are the most active. Peak activity is reached by the males when searching for a mate. The activity of the females is generally less than that of the males, although the duration, in many species, may be much longer. (Female spiders are more long-lived than the males and have to care for the development of the eggs and egg-laying; furthermore they have a potentiality to produce more egg cocoons after one occasion of sperm reception.) (See Tretzel 1954, Heydemann 1960.)

To determine the "Reifezeit" (the time during which adult specimens occur) on the basis of pitfall trapping data alone, as has been done by some German authors, is not, however, sufficient. The trap captures only reflect the ground-surface activity of the animals, and in order to obtain a more complete picture of the time during which adults occur, other sampling

Entomol. Ts. Årg. 89. II. 1–2, 1968

methods (sifting, sweeping) are necessary (cf., e.g., *Centromerus arcanus* below).

After the notes on each species dealt with, the author has tried to list the literature in order to present their known distribution. The validity of the determinations, especially in the older literature (before 1939 references are made to Bonnet (1945, 1956)) may in some cases be uncertain.

This paper is based on material seen and redetermined by me in the Museum of Natural History, Stockholm (material brought together mainly by the late Professor A. Tullgren), material in the Dept. of Zoology, University of Uppsala (the collection of Dr. Åke Holm) and specimens of my own collection. The activity data of *C. sylvaticus* and *C. expertus* are partly based on material collected in the winter season by Dr. Olof Näsmark and determined by me.

In the annotated find lists below, the names of the Swedish provinces are abbreviated according to Catalogus Insectorum Sueciae (Lund 1940—60). In connection with the specimens collected by A. Tullgren and by Å. Holm the abbreviations AT and ÅH are written respectively.

RM=Museum of Natural History, Stockholm

UZM=Department of Zoology, University of Uppsala

Author's coll.=In the author's collection and collected by him if not otherwise stated.

Centromerus incilius (L. Koch). Not previously reported from Sweden.

RM: Sk. Höör 7/6 43 (no spec. in the tube) (AT). - Hall. Enslöv 1♀ 20/4 51, 2♀♀ 20/8 51 (H. Andersson). - Sm. Tranås 1♀ 24/6 43 (AT). - Sdm. Torshälla 1♂ 3♀♀ 9. 43, 1♀ 5. 44, 1♀ 6. 44, 1♀ 8. 44, 1♀ 9. 44 (A. F. Grönberg); Ärla, Skogshall 1♀ 6. 44, 1♀ 8. 44 (A. F. Grönberg); Nacka, Söderbyskogen 1♀ 20/6 42 (AT). - Upl. Runmarö, Nore-Uppeby 1♀ 23/9 49 (Helfrid Tullgren); Runmarö, Nore 1♀ 23—29/6 45 (AT), 4♂♂ 1♀ 22/9 49 (Helfrid & A. Tullgren); Runmarö, Nore-Kila 1♀ 23/9 49, 1♂ 13/9 49 (Helfrid & A. Tullgren); Sandön 2♀♀ 16/9 49 (AT); Stockholm, Ent. Anst. 1♀ 27/5 05, 1♂ 25/9 05, 2♀♀ 11. 07(AT); Stockholm, Exp. fältet 1♀ 16/11 17 (AT); Lidingö, Bosön 4♀♀ 26/11 40 (Helfrid & A. Tullgren); Lidingö, Stockbyskogen 1♀ 20/4 42 (AT); Bromma, Rockstasjön 2♀♀ 8/6 46 (AT); Sånga, Igelvikens 1♀ 31/5 42 (AT); Danderyd, Mörby 2♀♀ 12/5—14/6 41, 1♂ 1♀ 12/10 41 (AT); Täby, Lötingekullen 7♂♂ 11♀♀ 8—27/9 42 (AT); Tureberg, Bergendal 1♀ 28/9 44 (AT); Össebygarn, Karby 2♀♀ 12/10 05 (AT); Bergsbrunna 1♀ 1/4 99 (AT); Uppsala 1♂ 09, 1♀ 15/3 10 (O. Lundblad); Vänge, Fiby 1♀ 6—9/5 45, 2♂♂ 17/10 45 (O. Lundblad), 1♀ 6/5 45, 2♂♂ 2♀♀ 15/10 47 (AT); Björkö-Arholma, Simpnäs 2♂♂ 2♀♀ 3/10 47 (AT); L. Änklingen 3♀♀ 30/9 47 (AT); Öregrund 2♂♂ 10♀♀ 4—6/10 48 (Helfrid & A. Tullgren); Gräsö 1♀ 22/6 46 (AT); Gräsö, Västerbyskogen 1♂ 1♀ 5/10 48 (Helfrid & A. Tullgren); Gräsö, Österby 2♂♂ 5/11 48 (AT). - Dlr. Malingsbo, Lövtjärn 1♂ 7. 41 (K.-H. Forsslund). - Ly. Lpm. Tärna 1♀ 1/7 37 (ÅH). — **UZM:** Boh. Skaftö 1♀ 1/7 44 (ÅH); Skaftö, Klubban 1♂ 25/9 66 (ÅH). - Upl. Uppsala, Norby 2♀♀ 30/4 34 (ÅH); Bergshamra 1♂ 10/9 61 (ÅH); Åkerby 1♂ 3♀♀ 19/4 61 (ÅH). - Hls. Ljusne, Söderala 1♀ (K. Öblom). - Jmt. Frösön, Östberget 1♀ 5/7 34 (ÅH); Laxviken 1♂ 23/10 57 (S. A. Svensson). - Vb. Vendeln 1♂ 31/7 41 (ÅH). - Nb. Saittajärvi 1♀ 8—13/7 61 (trap) (ÅH). — **Author's coll.:** Ög. V. Eneby, Tjukberget 6♂♂ 2♀♀ 20/2 67 (sifting lichen cover (*Cladonia*) on wooded rocks; the actual spots were not covered with snow). - Sdm. Vagnhärad, N. Askö 2♂♂ 2♀♀ 16/10 66 (sifting lichen cover (*Cladonia*) on rocks with pines); Nacka, Nackareservatet, near Lake Dammtorpssjön, traps: 1♂ 2—15/5 65 (alder trees, *Prunus padus* (dense), *Anemone nemorosa* and *Oxalis acetosella*, much leaf litter, not far from the shore), 1♀ 6/4 66 (day-time, trap on the rocky hill with pines and patches of *Calluna* and bare spots with needle litter), 2♂♂ 9—10/4 66 (night-time, different traps in the same site as previous specimen), 1♂ 20—23/4 (same site as previous specimens), 1♂ 29—30/4 66 (night-time, trap situated on the slope (partly grassy) of the hill), 1♂ 30/4—2/5 66 (in *Calluna* on the hill mentioned), 1♀ 3—4/5 66 (night-time, as previous), 1♀ 6—14/5 66 (as previous), 2♀♀

14—29/5 66 (one trap in *Calluna* on the hill mentioned, the other on the grassy slope of the hill), 1♂ 29/5—9/6 66 (in *Calluna* on the hill), 1♀ 9—18/6 66 (as previous), further specimens see Fig. 4. - *Upl.* Lovö, near Sötvattenslaboratoriet (edge of a conifer wood (with grasses and shrubs) facing south towards a cultivated field), traps: 1♀ 16—23/2 64 (partly snow cover), 1♂ 23/2—1/3 64 (do.), 1♂ 15—23/3 64 (snow-free where the traps were placed), 2♂♂ 23—29/3 64, 2♂♂ 29/3—3/4 64 (trapping began 16/2 and ended 3/4 64); Lovö, Kärsö 1♂ 28/3—4/4 (trap situated in a belt of alder trees near a shore); Vallentuna, Sjöboda 2♂♂ 4♀♀ 27/11 66 (sifting of lichens and *Calluna* on rocks with pines, no snow); Lidingö, Långängen 3♂♂ 5♀♀ 1/10 67, 3♀♀ 12/11 67 (sifting lichen cover (*Cladonia*) and *Calluna* on wooded rocks); Lidingö, Furutorp, traps: 1♂ 30/4—14/5 63 (edge of a wood), 2♂♂ 16—31/3 64 (uncultivated field), 1♂ 30/4—14/5 64 (edge of a wood) (O. Näsmark leg.); Väddö, Grisslehamn 2♂♂ 3♀♀ 15/10 67 (sifting lichen cover (*Cladonia*) on wooded rocks), Väddö, Rönnskärssudd 2♀♀ 15/10 67 (sifting of lichen cover (*Cladonia*) on a rock with pines surrounded by spruce forest with moss cover (*Hylocomium* and others); *C. arcarius* ♂♂ ♀♀ were found by sifting *Hylocomium*). - *Dlr.* Los, Hamra National Park 1♀ 16/7 63 (sifting *Cladonia* in pine wood).

From the list above it is apparent that the distribution of this species in Sweden extends far into the northern parts of the country.

According to the list above (trap catches) and Fig. 4 it can be seen that the activity has been recorded mainly in the winter and spring. (Unfortunately no traps were set out when snow covered the ground in Nackareservatet, where the activity was not too low.) In Germany, Tretzel (1954) described *C. incilius* as a true winter-active species ("winterreife Art"). This has also been confirmed in Britain (Duffey & Millidge 1954) and in Slovenia (Polenec 1962, 1965).

When only taking into consideration the material from *Upl.* and *Sdm.* it seems that adults of a new generation appear in the autumn and females of this generation can still be found in the following summer. Huhta (1965) assigns *C. incilius* to a group of spiders with two maxima ("maxima in the spring and autumn") and in the case of this species he got males only in the autumn (based on sampling per unit area). However, his material was rather small and generalizations should be avoided.

Although this species is considered to be rather rare according to continental European and British literature, it seems from my own experience to be common in suitable places, at least in the vicinity of Stockholm. As can be seen from the species list I have mostly obtained it by sifting lichen cover on wooded (mostly pines) rocky hills on which there was often a patchy field layer of *Calluna*. The habitats reported in the literature have often indicated that this species is found in localities which would be regarded as relatively "dry" in summer time (e.g. Buchar & Žďárek 1960, Herzog 1961, von Broen & Moritz 1964, Duffey 1965). Huhta (1965) obtained this species, except for one specimen, only in a "Calluna type pine stand" and "Calluna type seedling" (pine seedlings) of the Finnish forest types investigated by him. However, the habitats of *C. incilius* preserve a high humidity during the winter when the species is mature and active (Herzog 1961, Duffey 1965), but little can be said about the microclimatic influence and preference during the summer conditions in these apparently "dry" major habitats where the humidity close to the ground in areas covered by a field layer may be high. Also, we have to know more about the ecological preference of the immature stages.

Distribution: Britain, Norway, France, Switzerland, Slovakia, Austria, Germany, Hungary, Balkan (Wiehle 1956), Finland (Lehtinen 1964 a), Denmark (Bøggild 1962), Holland

(van Helsdingen 1963), Sweden. It has also been reported from Italy, Poland and U.S.S.R. (literature compiled by Bonnet (1956)).

Centromerus sylvaticus (Blackwall). This species is probably common all over Sweden, the northernmost find being reported from *T. Lpm.* Vadvetjåkko National Park, 1 ♂ 17/7 30, preserved in RM, (Holm 1950); and it is even found in the subalpine region (Holm 1950, 1958).

Buche (1966) has studied the ecology and biology of this species in Bavaria. It belongs to the winter-active species, as has been shown by other authors (summarized in Buche, op. cit.). The data on seasonal activity obtained from pitfall trapping on the European continent (Germany: Greifswald (von Broen & Moritz 1963), Numburg (Hiebsch 1962), Mainz (Braun 1955), Erlangen (Tretzel 1954) and in Slovenia (Polenec 1962)) and Britain (Duffey & Millidge 1954) are in fairly good agreement with the seasonal activity of this species in the vicinity of Stockholm. The activity histogram (Fig. 1) is based on captures from *Upl.* Lidingö, Furutorp 1963—64 and according to this the main activity was recorded in late autumn. The trapping area included both part of a wood (oaks and conifer trees) and part of a grassy uncultivated field, including the edge of the wood with birch and alder (Näsmark 1964). Most of the *C. sylvaticus* captured was trapped in the wooded area and the edge of the wood. In the field the capture of *C. sylvaticus* was smaller than in the wooded area and was exceeded in number by the almost isochronous *Centromerita bicolor* (Bl.), of which single specimens were trapped in the wooded area. Concerning the seasonal activity of *C. sylvaticus* the same results have been obtained in my investigation area in Nackareservatet (Fig. 4).

The life cycle of *C. sylvaticus* seems to be essentially the same in the vicinity of Stockholm as on the Continent. Thus Buche (op.cit.) assumes that a new generation begins to reach maturity in late summer and autumn, and females found in the following summer belong to this generation. Whether this also holds for northern Sweden is questionable (cf. the male from Vadvetjåkko mentioned above). The longevity of female spiders is generally longer than that of males and Buche (op.cit.) showed that one of the *sylvaticus* females which he had in captivity could produce as many as seven cocoons.

Distribution: Europe, Soviet Union (to Kamtschatka), Japan (uncertain, only 1♀ found), North America (summ. by Buche, op.cit.) and Aleutian Islands (Holm 1960). Thus this is a holarctic species.

Centromerus prudens (O.P.-Cambridge). Not previously reported from Sweden.

RM: Vg. Mölndal 1♀ (I. B. Ericsson). - *Upl.* Danderyd, Mörby 1♂ 16/10 40 (AT); Sandön 1♂ 11/9 48 (AT). - Öl. Glömminge 1♀ 28/10 48 (N. Bruce). — **UZM:** Gtl. Högklint 1♀ 7/4 50 (ÅH). — **Author's coll.:** Sdm. Västerhaninge, Häringe 1♀ 8/9 63; Vagnhärad, N. Askö 1♂ 16/10 66; Nacka, Nackareservatet 1♂ 9—23/11 65 (trap), further specimens see Fig. 4.

This species is "widespread throughout the British Isles, but commoner in the north than in the south" (Locket & Millidge 1953). In Germany it has been recorded in only few places and according to the literature this species

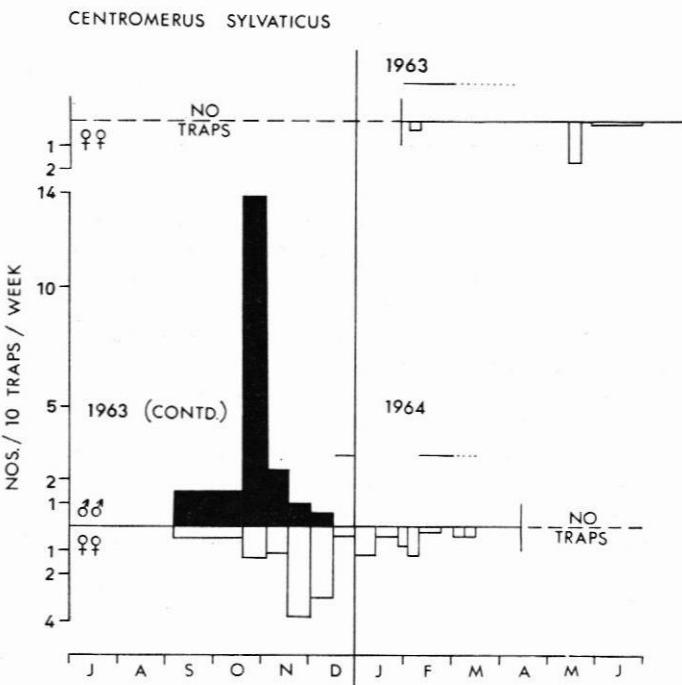


Fig. 1. Seasonal activity of *Centromerus sylvaticus* (Bl.) in Upl. Lidingö, Furutorp 28/1 1963—13/4 1964. Trap catches of males (black) and females from each trapping period presented as catch /10 traps/ week. Only catches from the wood and the edge of the wood included. The continuous and dotted lines above each histogram refer to the times during which there was a continuous snow cover and partly snow cover respectively. Note: There was only 1 ♀ from May and 1 ♀ from June 63, but as only 6 traps were operated by then, these columns are not comparable with the rest, which are based on 18—25 traps.

prefers places with mosses and heather in conifer woods (von Broen & Moritz 1964). The male from Askö was caught together with *C. incilius* by sifting *Cladonia* on a rock with pines, the male from Nackareservatet was caught in trap no. IXA (for description see p. 120 ff.) and two females from spring '67 were caught in traps no. XA and XB (where *C. incilius* was caught, too). According to the literature (e.g. Locket & Millidge 1953, Wiehle 1960, von Broen & Moritz 1963, 1964) this species occurs in the adult stage in autumn, winter and spring, which is in accordance with the find dates presented from Sweden.

Distribution: British Isles,¹ France, Germany (Wiehle 1956), Holland (van Helsdingen 1963), Denmark (Bøggild 1962), Iceland (Braendegård 1958), Sweden. It has also been reported from Belgium, Switzerland, Spain, Portugal, Italy and Roumania (literature compiled by Bonnet (1956)).

¹ Wiehle (1956) stated England, but here British Isles is stated according to Bristowe, W.S., 1939. The Comity of Spiders. Vol. 1. Ray Society, London.

Table 1 (explanation in text).

	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
♂♂	—	—	—	1	8	1	—	—	5	8	1	1
♀♀	—	—	—	1	8	19	3	7	12	15	1	2

Centromerus arcanus (O.P.-Cambridge). First reported by Holm (1940) this species seems to be distributed all over Sweden, and I have often taken it by sifting of mosses (*Ptilium*, *Hylocomium* and others) in conifer woods. It is also often to be met with in marshy places with e.g. *Sphagnum*. In the Swedish Mountains *C. arcanus* is found even in the subalpine region (Holm 1950, 1958 and present author, unpubl.).

According to Locket & Millidge (1953) adults are found from autumn to spring in Britain. Wiehle (1965) states: "Reife Männchen und Weibchen wurden in allen Monaten des Jahres angetroffen". Rabeler found 2 subad. ♂♂ in Aug. and Sept. respectively and 13 ♂♂ in Sept. in spruce forests in the Harz (Braun 1961). As regards data on activity period, Tretzel (1954) classed this species as "winterreif". von Broen & Moritz (1963) trapped males only in the latter part of April and in May and a single male in October. In Nackareservatet (Fig. 4) the male activity was mainly restricted to May, thus agreeing with the data from Greifswald. In 1965 and in 66 the male activity in Nackareservatet was also restricted to the same period. Above (Tab. 1) is summarized the material of this species (not obtained by trapping) preserved in RM separated into the months in which the specimens have been taken. (Only material from *Sdm.* and *Upl.* is included, in order to eliminate possible regional differences. Naturally this table gives only a rough picture as the material is very heterogenous having been taken by different collectors, in different years, different collecting activity of the collectors, etc. Only each collecting occasion and locality is noted for presence of males and females respectively.) It can be seen from Table 1, that adults have been found on relatively many occasions in the autumn (this applies also to material of my own not presented), and males were not represented in July and August. Huhta (1965) reported *C. arcanus* (from Finnish forests) from all months of the year (samples per unit area). He found high densities of this species during the cold half of the year and only females were found in the summer months. On the basis of these facts it seems plausible that adults of a new generation appear in late summer and autumn, overwinter as adults and mate in the following spring. In material of my own from Dlr. Hamra National Park (primeval conifer forest, moss carpet of *inter alia* *Hylocomium* and *Ptilium*) active males were captured even between 28 June and 18 July 62, more males however between 11 June and 28 June (traps set out only between 11 June and 18 July 62). Perhaps the activity in more northerly parts of Sweden is somewhat displaced owing probably to climatic factors.

Distribution: British Isles (see footnote on p. 115), France, Switzerland, Czechoslovakia, Hungary, Finland, U.S.S.R. (Wiehle 1956), Poland (Dahl 1902), Belgium (Denis 1958), Spain (Denis 1962), Sweden. Also reported from Andorra, Transsylvania, Denmark and Norway (lit. compiled by Bonnet 1956, but not Holland (van Helsdingen 1963)).

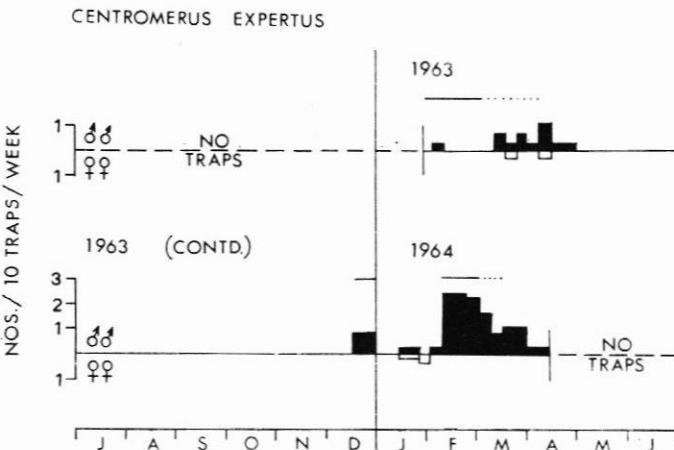


Fig. 2. Seasonal activity of *Centromerus expertus* (O. P.-Cambr.) (same locality, time and presentation as in Fig. 1). Only catches from the uncultivated field and the edge of the wood included.

Centromerus aequalis (Westring) (= *C. brevipalpus* (Menge)). Westring (1862) took this species in Gothenburg, Wetter (1874) reported it from Sk. Ringsjön, Johansson (1943) found it in Bl. in places with alder trees (♂♂ March—May, December).

RM: The Westring specimens. — *Sdm.* Utö, Krokarna 1♀ 25/8 48 (Helfrid & A. Tullgren). — **UZM:** Sk. Kullen, Mölle 1♀ 4/6 42 (ÅH). - *Bl.* Karlshamn, Tubbaryd 1♀ 12/12 40 (ÅH). - *Gtl.* Höglint 2♂♂ 7♀♀ 7/4 50 (ÅH).

According to Wiehle (1956) and Miller (1958) this species is found in autumn, winter and spring in the adult stage, and Wiehle (op.cit.) presumes that it may be a "winterreif" species.

Distribution: Sweden, France, Switzerland, Germany, Czechoslovakia, Austria, Hungary, Balkan and U.S.S.R. (Wiehle 1956), Belgium (Denis 1958), Holland (van Helsdingen 1963), Finland (Häkkilä *et al.* 1968). It has also been reported from Italy, Poland and Denmark (lit. compiled by Bonnet 1956).

Centromerus expertus (O.P.-Cambridge). First reported from Sweden by Thorell (1871, from Ög.) this species is well represented in RM from South and Central Sweden (a very northerly find is 1♀ in RM taken by T. Palm in *T. lpm.* Karesuando 22/6 1947). *C. expertus* belongs to the spiders which are active in the winter. Phenological data from Greifswald (von Broen & Moritz 1963) show that the male activity period is about the same as that shown (Fig. 2) in a locality (*Upl.* Lidingö, Furutorp) in the vicinity of Stockholm. A "Diplochronie" which Tretzel (1954) deduced from his material can thus not be shown in the material from Lidingö, but a slight male activity was shown in Sept.—Oct. in *Sdm.* Nackareservatet (Fig. 4) (cf. Heydemann 1960). Nor can I adopt the statement ("adults in summer and autumn") by Locket & Millidge (1953) in regard to my material, but Wiehle's (1956) state-

ment ("nur im Sommer sind Reife Tiere beiderlei Geschlechts nicht gefunden worden") seems to fit with the circumstances in South and Central Sweden (material in RM and my own collection). Thus it is plausible that a new generation reaches maturity in the autumn and females which still can be found in the following summer belong to this generation.

Concerning the material from Lidingö it is worth mentioning the periods in which a continuous snow cover existed all over the trapping area. In the spring of 1963 the snow cover was continuous until the beginning of March and then began to disappear first of all at the edge of the wood. In December 63 there was a continuous snow cover during the second half of this month and between 10 Febr. and 2 March 1964. From Fig. 2 it can be seen that a great deal of the activity in the winter of 1963/64 was registered during the two periods with a continuous snow cover. During these periods, too, the lowest maximum and minimum temperatures were registered (however it has been shown (Coulianos & Johnels 1962) that a sufficient snow cover acts as a very good insulator of the subnivean space).

This species seems to prefer habitats with a rather high moisture (summer conditions), but although I have found it associated with the spider fauna of shores with a dense field layer and the parts of adjacent woods just close to the shores (see Fig. 4), *C. expertus* is by no means restricted to shore habitats but can be found in very different conditions (woods, fields, marshes, etc.) provided they can offer the probably required moisture. In the trapping area of Lidingö, *C. expertus* was mostly taken in the traps on the edge of the wood, along which there was a small ditch (for description of locality see under *C. sylvaticus*).

Distribution: All Europe (Wieghe 1956).

Centromerus levitarsis (Simon). Not previously reported from Sweden.

RM: Sdm. Årla, Skogshall 1♀ (A. F. Grönberg). - *Upl.* Sundbyberg, Lötsjön 3♀♂ 31/5 43, 3♀♀ 13/7 43 (AT); Gräsö, Österbysjön 2♀♀ 5/6 48 (Helfrid & A. Tullgren). — **UZM:** *Upl.* Uppsala, Nästen 1♂ 1♀ 10/9 42 (ÅH); Uppsala, Norbyskogen 1♀ 23/5 39 (ÅH); Uppsala Eriksbergsskogen 1♂ 17—24/4 61 (trap) (ÅH); Bälinge, Ryggmossen 1♂ 29/4—14/5 62, 1♂ 14—21/5 62 (traps) (ÅH). I have also seen 1♀ from Vrm. Karlstad, Lövnäs 13/4 67 collected by Mr. Hartvig Nilsson, Karlstad, who kindly allowed me to include his find in this list.

According to Locket & Millidge (1953) and Wieghe (1956) adults of this species have been recorded from autumn, winter and spring, which also holds true for the Swedish finds (note the male activity in April—May obtained through trap catches by Holm).

Distribution: Britain, France, Germany (Wieghe 1956), Czechoslovakia (Miller 1958), Estonian SSR (Vilbaste 1964), Holland (van Helsing 1963), Poland (Pilawski 1965), Finland (Lehtinen 1964 b). Also reported from Italy (lit. compiled by Bonnet 1956).

Centromerus alnicola Schenkel. Not previously reported from Sweden.

RM: Sm. Tranås 5♀♀ 22—23/6 43 (AT). - *Hls.* Färila 1♂ 2♀♀ 3/6 41 (O. Lundblad). - *Gtl.* Stora Karlsö 1♀ (N. Linnman). — **UZM:** *Upl.* Bälinge, Ryggmossen 1♀ 16/9—22/10 61 (trap) (ÅH). - *Jmt.* Undersåker 1♀ 30/6 41 (ÅH). - *Nb.* Överkalix, Kalix älv 1♀ 15/7 61 (ÅH).

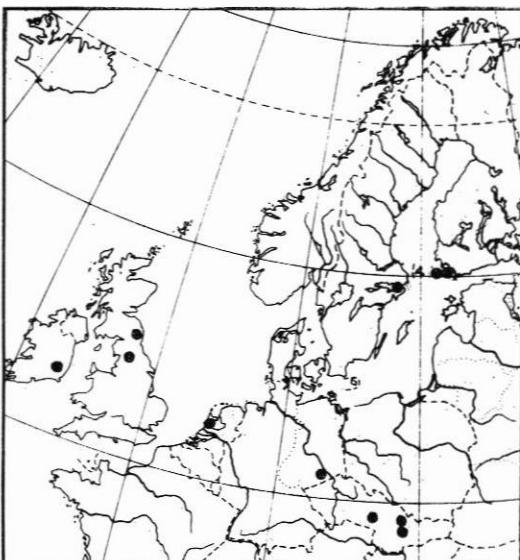


Fig. 3. The hitherto known find localities of *Centromerus persimilis* (O. P.-Cambr.).

According to Wiehle (1960) this species is found in the adult stage from autumn to spring. The poor Swedish material does not permit any statements. Vilbaste (1964), who collected spiders during the vegetation period from April to October, found this species in each of these months, except for July.

Concerning the Swedish distribution of this species the very northerly find (Överkalix) is noteworthy.

Distribution: Germany, Czechoslovakia (Wiehle 1960), Holland (van Helsdingen 1963), Estonian SSR (Vilbaste 1964), Finland (Lehtinen, *in litt.*), Sweden.

Centromerus persimilis (O.P.-Cambridge) (=*C. strandi* Miller). Not previously reported from Sweden. Locket (1962) finally confirmed that *C. persimilis* and *C. strandi* were synonymous. The specimens found in Sweden is identical with *C. persimilis* when compared with the drawings of the palpus presented by Miller (1937, 1958), Locket (1962) and Wiehle (1965).

Author's coll.: Upl. Lovö, Kärsö 1♂ 14—21/3 65, 1♂ 3—16/5 65, 1♂ 4—22/5 67 (all in traps).

The traps in which my specimens were caught were situated in a wooded area near the shore of Lake Mälaren. The actual place was in a transitional area between a narrow zone of trees (preferably alders and small ashes, adjacent to a broad belt of shore vegetation which was flooded in winter and spring) on one side, and a wood, (mostly conifers) with different kinds of shrubs and a field layer of grasses on the other side. The actual site where the specimens from March 65 and May 67 (same trap) were caught was covered very sparsely with a vegetative grass (dense just around the trap) with *Oxalis* and a litter layer of leaves and needles from a nearby spruce.

Nearby grew *Poa nemoralis* (sparse) and single specimens of *Lactuca* sp., and on one side there were shrubs of *Ribes*. In March 65 the following adult spiders were also caught in this trap (together with *C. persimilis*): *Centromerus expertus* (O.P.-Cambr.) 1♂, *Stemonyphantes lineatus* (L.) 4♂♂ and *Lepthyphantes angulipalpis* (Westr.) 3♂♂. In May 67: *Antistea elegans* (Bl.) 1♀, *Ceratinella brevis* (Wid.) 6♂♂ 2♀♀, *Minyriolus pusillus* (Wid.) 2♂♂, *Tapinocyba pallens* (O.P.-Cambr.) 10♂♂, *Thyreosthenius parasiticus* (Westr.) 1♀, *Diplocephalus latifrons* (O.P.-Cambr.) 2♂♂, *D. picinus* (Bl.) 3♂♂ 1♀, *Porrhomma pygmaeum* (Bl.) 1♀ and *Lepthyphantes angulipalpis* (Westr.) 1♂. The actual site where the *persimilis*-specimen from May 65 was caught was covered with a litter layer of leaves and needles (no field layer) and situated under an elm. This trap was placed 4 metres to the side of the first mentioned. Together with this *persimilis*-specimen were caught: *Antistea elegans* (Bl.) 1♀, *Ceratinella brevis* (Wid.) 2♂♂, *Maso sundevalli* (Westr.) 1♀, *Tapinocyba pallens* (O.P.-Cambr.) 5♂♂, *Diplocephalus latifrons* (O.P.-Cambr.) 2♂♂ and *Pardosa paludicola* (Cl.) 1♂.

It is, however, difficult to draw any conclusions about preferable conditions of this species on the basis of the above information, as the spider species caught together with *C. persimilis* consist both of elements associated with the shore (e.g. *Antistea elegans*, *Porrhomma pygmaeum*, *Pardosa paludicola*) and of elements associated with the wood (e.g. *Ceratinella brevis*, *Tapinocyba pallens*, *Diplocephalus latifrons* and *D. picinus*). Besides, only males of *persimilis* were caught and, generally speaking, males show a wider ecological valence than do females.

Miller (1937) caught *C. persimilis* in damp moss in a dark wood (1♀ 12/11 34) and in moss in a swamp (1♂ 20/10 36). Miller (*in litt.*) has later found this species at Olsí near Brno "am schattigen Rande eines hohen Fichtenwaldes in Steinhäufen unter tief liegenden Steinen: 3♀♀ 21/9 64, 1♂ 1♀ 5/11 64".¹ Hiebsch trapped 2♂♂ 29/3 61 in a field at Oelsa, DDR (Wiehle 1965). The English find published by Locket (1962) was taken in a crevice of limestone pavement (1♂ Sept. 61).

This species is probably to be found in the adult stage from autumn to spring.

Distribution: Czechoslovakia, Germany, British Isles² (Wiehle 1965), Sweden.³

Habitat distribution of some Centromerus species in a locality near Stockholm (Fig. 4).

The activity histogram shows the habitat distribution of the *Centromerus* species obtained by trappings in Sdm. Nacka, Nackareservatet 22/8—29/12 1966 and 11/3—5/7 1967. The traps were set out at irregular intervals from the shore of Lake Dammtorpssjön through a deciduous wood on slightly sloping ground facing west with a rich leaf-litter layer (traps III—VIII), and a partly grassy treeless slope facing northwest before ending on a rocky hill with a light wood of pines with patches of *Calluna* (traps XA and XB).

A rough characterization of the different habitats with the more immediately apparent trees and herbs follows below as an indication of the

¹ I am very grateful to Professor František Miller, Brno, for allowing me to include these finds.

² See footnote on p. 115.

³ See addition on p. 127.

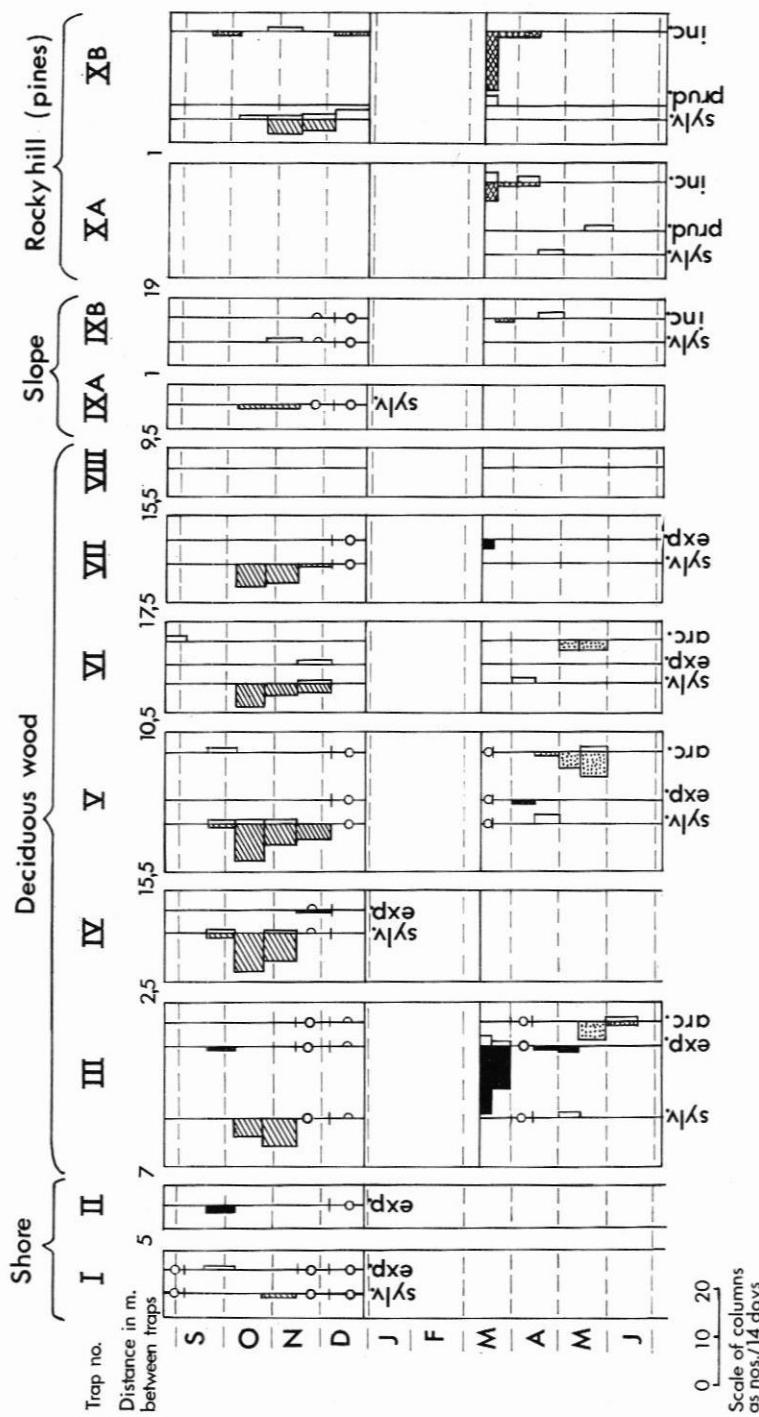


Fig. 4. Habitat distribution of some *Centromerus* species in Sdm. Nackareservat. Trap catches 22/8–29/12 1966 and 11/3–5/7 1967. Columns for males differently shaded according to species, columns for females white. Catch of each period equalized to 14 days' catch. -O- means that this trap was not operating during the period in question (for various reasons), Δ means that it was partly destroyed. Traps nos. I, II, IV and IXA were not set out during the spring. XA not during the autumn. Above is given the distances in metres between the traps.

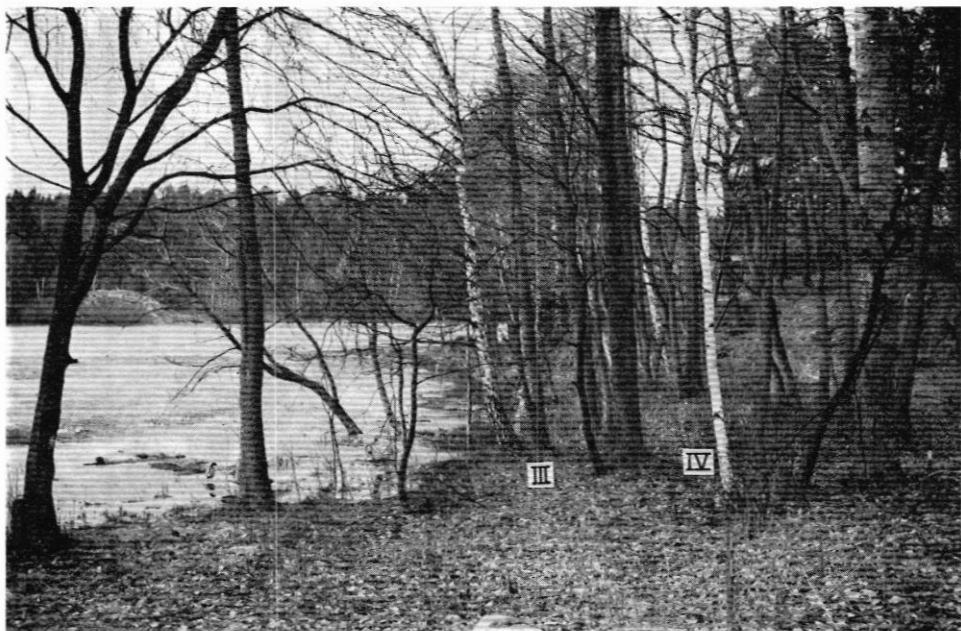


Fig. 5. The shore of Lake Dammtorpsjön and adjacent parts of the deciduous wood. Early vernal aspect. Site of traps III and IV (I and II flooded).

milieu, though the spider species are not affected by the plant species *per se* but by their structure and the degree in which they modify the microclimate.

Trap I was set out 5/9 at the inner border of a *Scirpus* zone (capture not representative, as it was sometimes waterfilled and finally flooded from November).

Trap II in a belt of *Carex acuta* and *Iris pseudacorus* (flooded when inspected 6/12).

Traps III and *IV* near the edge of the wood (alder trees, small aspens, *Prunus padus*, in spring much *Anemone nemorosa*; *Filipendula ulmaria* (rich) on one side of III; *Oxalis acetosella* noted at IV).

Traps V—VII in the wood with high aspens (V: small aspens, *P. padus*, *Lonicera xylosteum*, *Corylus avellana* (all forming a dense stand), *Deschampsia caespitosa*; VI: *P. padus*, *C. avellana*, *Anemone hepatica*, *Vicia sepium* and *Melica nutans*). At both V and VI *A. nemorosa*, *Viola riviniana*, *Geranium silvaticum* and *Geum rivale* were noted. At trap VII were noted *inter alia* small aspens, *A. nemorosa*, *G. silvaticum*, *G. rivale*, *Fragaria* sp., *Lathyrus pratensis*, *V. sepium*, *D. Caespitosa*, *Pteridium aquilinum*, between this trap and a nearby brooklet which passed between VI and VII a stand of *F. ulmaria*.

Trap VIII at the border between the deciduous wood and the slope of the hill: small oaks, *Rosa* sp., *A. nemorosa*, *Calamagrostis arundinacea*, *Deschampsia flexuosa*, nearby *Vaccinium* and *Calluna*.

Traps IXA and IXB in the slope: *C. arundinacea*, *D. flexuosa*; *Luzula pilosa* and *Dryopteris filix-mas* (at IXA); IXB 1 m. apart from a carpet of *Vaccinium myrtillus*.

Traps XA and XB on the hill with pines (XA at the border between *Calluna* stand and bare ground with needles; XB in a *Calluna* stand).

In spring 67 the water level of the lake was high and on 1/4 was noted that the water line was about 2 m. from trap III, and 19/6 about 4 m. from this trap.

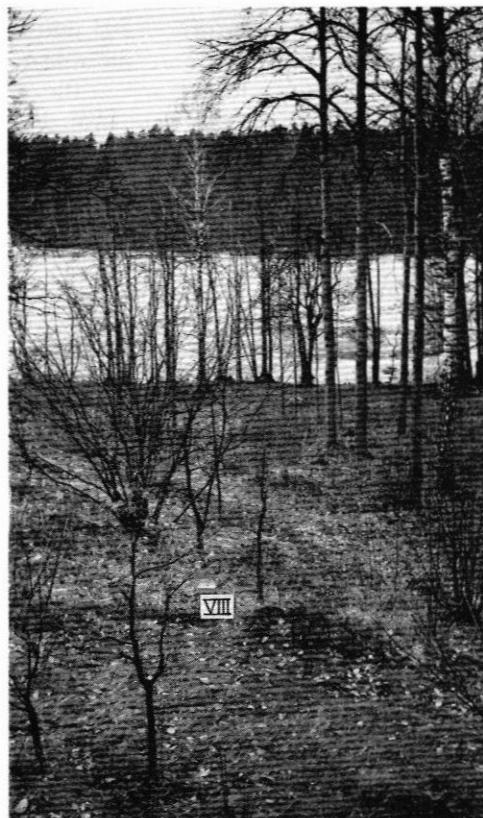


Fig. 6. Part of the deciduous wood. Early vernal aspect. Site of trap VIII shown (the traps in the deciduous wood were outside the photo to the right).

Concerning the *Centromerus* species obtained it can be noted that *C. expertus* was mainly restricted to the shore and adjacent parts. Tretzel (1952) called *expertus* "hemiombrophil-hygrobiонт" and this "ecological mark" does not contradict its appearance here. Most of the individuals were caught in trap III together with other markedly "hygrobionts" such as *Gnathonarium dentatum* (Wid.) and *Drepanotylus uncatus* (O.P.-Cambr.). Unfortunately I probably recorded a latter part of the male activity period of *expertus* in this locality. *C. sylvaticus* was recorded mainly from the deciduous wood and within the *Calluna* stand (XB). Tretzel (op.cit.) called it "hylobiont-hygrophil". A "hylophilous" appearance was also shown here in that very few specimens were caught in the more exposed slope. A preference for a wooded area was also shown in the locality of Lidingö (p. 114). *C. arcarius* was recorded to be active mainly in May and was restricted to the deciduous wood, which in May was shaded because the trees and shrubs had begun to come into leaf. *C. incilius* was restricted mainly to the traps in connection with the *Calluna* stand. Among other species caught at the same site at the same time were *Bolyphantes crucifer* (Menge) and *Macrargus rufus carpenteri* (O.P.-Cambr.), which also were restricted mainly to traps XA and XB, as were the two females caught of *Centromerus prudens*. It seems that only a latter period of activity of *C. incilius* was registered in the spring.

Some concluding and discussing points.

Spiders constitute a considerable part of the macroarthropods which are active on the ground surface in the winter. Most of the spider species found to be winter-active belong to fam. Erigonidae and notably to fam. Linyphiidae (also stated in unpubl. investigations in the Stockholm area). However, many representatives of these families overwinter as inactive adults and cannot be obtained by pitfall trappings at that time. It was earlier known that species of *Centromerus* are winter-active. This has now been established even from Central Sweden. On the basis of museum material seen and my own collections as well as data on the seasonal activity, plausible life cycles in the actual area have been *indicated* for those species for which representative material is available. These species are all found to overwinter in the adult stage, but differ in their mating periods (probably all the Swedish *Centromerus* species overwinter as adults). Species of this genus not found in Sweden also seem to overwinter as adults (see e.g. Kaston 1948, Locket & Millidge 1953, Wiehle 1956, 1960, Polenec 1962).

For Central Sweden it can be established that males of *C. sylvaticus* are active mainly in late autumn and early winter. It is remarkable that its very "distinct" peak of activity falls in about the same period in all areas investigated, in Slovenia as well as in Central Sweden. A slight difference exists, however. In Slovenia the peak occurs in December while in Sweden it occurs in October—November. An analysis of this difference is difficult to make at this stage without further investigations (e.g. of day-length and climate; mean temp. in Slovenia (Postojna) not far from where Polenec (1962) trapped *C. sylvaticus*: Nov. 57 5.3°C, Dec. 57 1.6°C, Jan. 58 –1.0°C; mean temp. in Sweden (Stockholm): Oct. 63 7.7°C, Nov. 63 3.2°C, Dec. 63 –1.2°C, Jan. 64 –1.3°C. These differences may be of significance). Males of *C. expertus* were proved to be active even in mid-winter under a snow cover, but single males have also been trapped in autumn and spring. (However differences in local conditions such as exposure, depth of snow cover may influence the trapping results.) Active *C. incilius* males were trapped mainly in winter and spring. *C. arcarius* showed a male activity period mainly in May, thus not being winter-active.

By comparing Central Swedish data (present author, not here presented unpubl.) and records from Central Europe (and Britain) it seems that the periods of maturity and activity (notably of the males) of several spider species investigated in detail are, on a large scale, rather consistent.

It is interesting that the adult occurrence period for many spider genera seems to be similar for the different species within each genus (e.g. the *Centromerus* species seem to occur as adults mainly in autumn, winter and spring while the species of, e.g., the linyphiid genus *Agyneta* seem to occur as adults in spring, summer (and autumn), both genera being univoltine).

The existence of a difference in habitat distribution between different *Centromerus* species which has been shown in Fig. 4 in a relatively small area may partly be due to different environmental requirements of the females and the immature stages as regards the conditions during warmer seasons when influencing factors are more diversified in different habitats. Further investigations are of course needed to confirm this hypothesis.

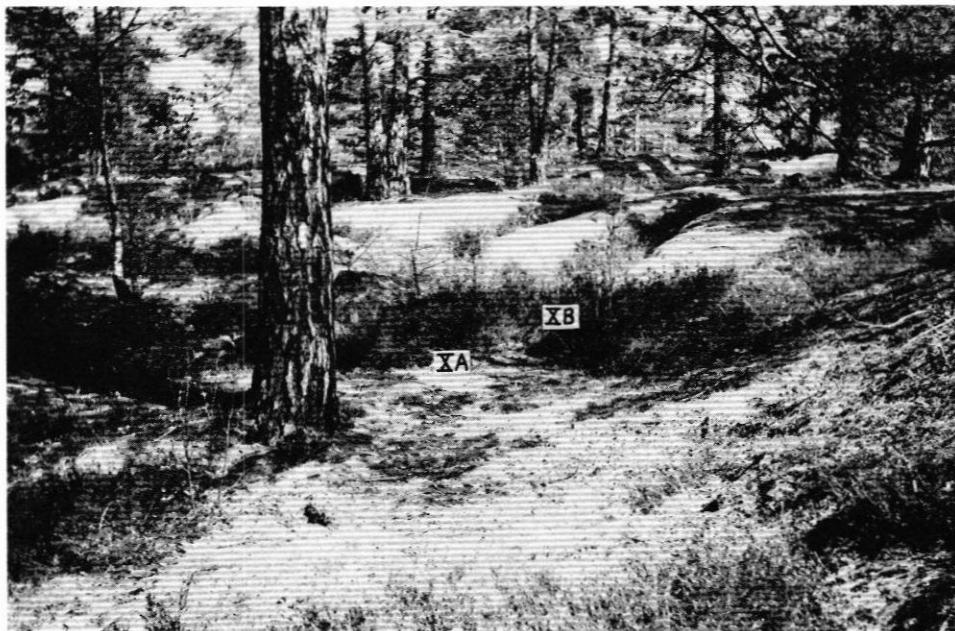


Fig. 7. Part of the pine wood on the rocky hill with *Calluna* stands. Late vernal aspect.
Site of traps XA and XB shown.

Summary

The following spider species are reported as new to the Swedish fauna: *Centromerus incilius* (L.K.), *C. prudens* (O.P.-Cambr.), *C. levitarsis* (Sim.), *C. alnicola* Schenkel and *C. persimilis* (O.P.-Cambr.). Notes on habitat distribution and seasonal activity are given mainly for *C. incilius*, *C. sylvaticus* (Bl.), *C. arcarius* (O.P.-Cambr.) and *C. expertus* (O.P.-Cambr.). Indications are also given of life cycles based on material in collections and data on seasonal activity.

Acknowledgments

I wish to express my great thanks to Dr. Åke Holm, Uppsala, who unselfishly allowed me to include his material in this communication and for help and advice in different cases as well as commenting on my manuscript, to Professor Lars Brundin of the Museum of Natural History, Stockholm, for allowing me to publish the material of the Museum, and to Dr. Olof Näsmark, Stockholm, for permitting me to determine and include his material of *Centromerus* from Lidingö. My thanks are also due to Dr. C.-C. Coulianos, Stockholm, and Dr. E. Duffey, Monks Wood Experimental Station, Abbots Ripton (Hunts.), England, for reading the manuscript. Dr. Duffey also gave valuable criticism.

Literature

- BONNET, P., 1945, 1956. *Bibliographia Araneorum*. Tome I et Tome II (2^{me} partie). Toulouse.
BØGGILD, O., 1962. Spiders from Bommerlund Plantation, a Spruce Forest in South Jutland. *Ent. Medd.* 31: 225—235.

- BRAENDEGÅRD, J., 1958. Araneida in The Zoology of Iceland. Vol. III, part 54.
- BRAUN, R., 1955. Zur Spinnenfauna von Mainz und Umgebung, mit besonderer Berücksichtigung des Gonsenheimer Waldes und Sandes. *Jb. Nass. Ver. Naturk.* 92: 50—79.
- 1961. Zur Kenntnis der Spinnenfauna in Fichtenwäldern höherer Lagen des Harzes. *Senck. biol.* 42: 375—395.
- BROEN, B. v. & MORITZ, M., 1963. Beiträge zur Kenntnis der Spinnenfauna Norddeutschlands. I. Über Reife- und Fortpflanzungszeit der Spinnen (Araneae) und Weberknechte (Opiliones) eines Moorgebietes bei Greifswald. *Dtsch. Ent. Z. N.F.* 10: 379—413.
- 1964. Beiträge zur Kenntnis der Spinnenfauna Norddeutschlands. II. Zur Ökologie der terrestrischen Spinnen im Keifernmischwald des Greifswalder Gebietes. *Dtsch. Ent. Z. N.F.* 11: 353—373.
- BUCHAR, J. & ŽDÁREK, J., 1960. Die Arachnofauna der Mittelböhmischen Waldsteppe. *Acta Univ. Carolinae, Biol.* 1960: 87—102.
- BUCHE, W., 1966. Beiträge zur Ökologie und Biologie winterreifer Kleinspinnen mit besonderer Berücksichtigung der Linyphiiden *Macrargus rufus rufus* (Wider), *Macrargus rufus carpenteri* (Cambridge) und *Centromerus silvaticus* (Blackwall). *Z. Morph. Ökol. Tiere* 57: 329—448.
- COULIANOS, C.-C. & JOHNELS, A., 1962. Note on the subnivean environment of small mammals. *Ark. Zool. Ser. 2*, Bd 15 nr 24.
- DAHL, F., 1902. Über die Stufenfänge echter Spinnen am Riesengebirge. *Sitzungsber. d. Ges. naturf. Freunde zu Berlin* 1902: 185—203.
- DENIS, J., 1958. Quelques micro-araignées de Belgique. *Bull. Inst. Sci. nat. Belg.* 34 no. 29.
- 1962. Quelques araignées d'Espagne centrale et septentrionale et remarques synonymiques. *Bull. Soc. hist. nat. Toulouse* 97: 276—292.
- DUFFEY, E., 1965. The Distribution of some rare Breckland Spiders. *Trans. Suffolk Nat. Soc.* 13: 67—78.
- & MILLIDGE, A. F., 1954. *Centromerus incilium* (L. Koch), a Linyphiid spider taken near Oxford, with Notes on Related Species. *J. Soc. Brit. Ent.* 4: 218—223.
- HÄKKILÄ, P., KOPONEN, S., LEHTINEN, P. & SAARISTO, M., 1968. Studies on the spider fauna of the southwestern archipelago of Finland. II. Ålandian mainland and the island of Eckerö. *Ann. Zool. Fenn.*, in print.
- HELDINGEN, P. J. v., 1963. The Micryphantidae and Linyphiidae (Araneida) of the Netherlands, with some notes on the genus *Leptophantes* Menge, 1866. *Zool. Verhand.* Leiden 62.
- HERZOG, G., 1961. Zur Ökologie der terrestren Spinnenfauna märkischer Kiefernheiden. *Ent. Z.* 71: 1—11.
- HEYDEMANN, B., 1960. Die biozönotische Entwicklung vom Vorland zum Koog. Vergleichend-ökologische Untersuchungen an der Nordseeküste. I. Teil: Spinnen (Araneae). *Akad. d. Wissensch. u.d. Lit., Mainz*, 1960 Nr. 11.
- HOLM, Å., 1940. Studien über die Entwicklung und Entwicklungsbiologie der Spinnen. *Zool. Bidr. Uppsala* 19: 1—214.
- 1950. Studien über die Spinnenfauna des Torneträskgebietes. *Zool. Bidr. Uppsala* 29: 103—213.
- 1958. Spindlar från Härjedalens fjälltrakter. *Ent. Tidskr.* 79: 216—230.
- 1960. On a collection of spiders from Alaska. *Zool. Bidr. Uppsala* 33: 109—134.
- HUHTA, V., 1965. Ecology of spiders in the soil and litter of Finnish forests. *Ann. Zool. Fenn.* 2: 260—308.
- JOHANSSON, R., 1943. Spindlar från västra Blekinge. III. Beriktigande och tillägg. *Ent. Tidskr.* 64: 118—120.
- KASTON, B. J., 1948. Spiders of Connecticut. *State Connecticut State Geol. Nat. Hist. Surv. Bull.* 70.
- LEHTINEN, P. T., 1964 a. Additions to the spider fauna of Southern and Central Finland. *Ann. Zool. Fenn.* 1: 303—305.
- 1964 b. The Phalangids and Pseudoscorpions of Finnish Lapland. *Ann. Univ. Turku. A, II*: 32: 279—287.
- LOCKET, G. H., 1962. Miscellaneous Notes on Linyphiid Spiders. *Ann. Mag. Nat. Hist.* 5 (49): 7—15.
- & MILLIDGE, A. F., 1953. British Spiders. Vol. II. Ray Society, London.
- MILLER, F., 1937. Neue Spinnenarten (Araneae) aus der Cechoslovakischen Republik. II. *Festschr. Embr. Strand* 2, Riga: 563—570.
- 1958. Beitrag zur Kenntnis der tschechoslovakischen Spinnenarten aus der Gattung *Centromerus* Dahl. (Mainly in Czech.) *Čas. Čs. Spol. ent.* 55: 71—91.

- NÄSMARK, O., 1964. Vinteraktivitet under snön hos landlevande evertebrater. Zool. Revy 26: 5—15.
- PILAWSKI, S., 1965. On some species of spiders new to Lower Silesia and Poland collected in the Polish Sudety Mountains. (In Pol. with Eng. summ.) Przegl. zool. 9: 254—265.
- POLENEC, A., 1962. Winterliche Arachnidenfauna und Assoziationen. (In Slovén. with Germ. summ.) Biol. Vestnik 10: 71—83.
- 1965. Untersuchungen der Arachnidenfauna im angepflanzten Föhrenwald (*Pinus nigra*) am Karst bei Divača. (In Slovén. with Germ. summ.) Biol. Vestnik 13: 77—85.
- THORELL, T., 1871. Remarks on Synonyms of European Spiders. Uppsala pp. 97—228.
- TRETELZ, E., 1952. Zur Ökologie der Spinnen (Araneae). Autökologie der Arten im Raum von Erlangen. Sitz. Phys.-med. Soz. Erlangen 75: 36—131.
- 1954. Reife- und Fortpflanzungszeit bei Spinnen. Z. Morph. Ökol. Tiere 42: 634—691.
- VILBASTE, A., 1964. Über die Fauna und Dynamik der Spinnen auf den Auwiesen Estlands. (In Eston. with Germ. summ.) Eesti NSV Tead. Akad. Toimet. 13, Biol. Seeria nr. 4: 284—301.
- WESTRING, N., 1862. Araneae Svecicae descriptae. Gothoburgi.
- WETTER, W. A. G., 1874. I Småland och Skåne hittills iakttagne spindlar etc. Diss. Lund.
- WIEHLE, H., 1956. Linyphiidae — Baldachinspinnen in Dahl, F.: Tierwelt Deutschlands. 44. Teil. Jena.
- 1960. Beiträge zur Kenntnis der deutschen Spinnenfauna. Zool. Jb. Syst. 88: 195—254.
- 1965. Beiträge zur Kenntnis der deutschen Spinnenfauna. IV. Mitt. Zool. Mus. Berlin 41: 11—57.

Author's address: Torbjörn Kronestedt
 Division of Ecology
 Dept. of Zoology
 University of Stockholm

Addendum. After this paper was set up I was informed of three unpublished find localities of *C. persimilis*:

Holland: south of Amsterdam, in a marshy habitat. 1 ♀ May 66 (trap). A. M. Kessler-Geschiere.

Finland (southwestern archipelago): Parainen, Onttala 1 ♀ 21/4 68; Korppoo, Åvensor 2 ♂♂ 27/4 68. M. Saaristo.

I want to express my great thanks to Mrs. Annette M. Kessler-Geschiere, Vrije Universiteit, Amsterdam, and to Mr. Michael Saaristo, Turun Yliopisto, Turku, for permission to include these finds.